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Treatment of chronic fatigue syndrome by dietary supplementation with ω-3 fatty acids – a good idea?

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Summary Minor alterations of immune, neuroendocrine, and autonomic function may be associated with the chronic fatigue syndrome. ω-3 fatty acids decrease the production of putative mediators of inflammation, including interleukin-1, and tumor necrosis factor. Since interleukin-1 and tumor necrosis factor are the principal polypeptide mediators of immunoregulation, reduced production of these cytokines by dietary supplementation with ω-3, may be a possible mechanism for the treatment of chronic fatigue syndrome. © 2002, Elsevier Science Ltd. All rights reserved.

BACKGROUND

Chronic fatigue syndrome (CFS) is a disorder of unknown etiology, consisting of prolonged or recurrent, debilitating fatigue, and a multitude of symptoms including flu-like symptoms, myalgia, weakness, arthralgia, low-grade fever, sore throat, headache, sleep disturbances, swelling and tenderness of lymph nodes and neurocognitive dysfunction for *6* months duration or longer (1–4). These symptoms are not caused by ongoing exertion; are not relieved by rest; and result in a substantial reduction of previous levels of occupational, educational, social, or personal activities (1,4).

Chronic fatigue syndrome is common in primary care patients and represents a considerable public health burden (5).

Definitive diagnosis can be very challenging. Because no markers objectively identify the presence of CFS, diagnosis depends heavily on the presence of subjective complaints (1). At present, no effective treatment for CFS is known (*6*).

The signs and symptoms, which include fatigue, myalgia, and low-grade fever, are similar to those experienced by patients infused with cytokines such as interleukin-1 (*7*). Minor alterations of immune, neuroendocrine, and autonomic function may be associated with this syndrome (2,3). Findings show an activation of the immune system, aberrations in several hypothalamic–pituitary axes and involvement of other parts of the central nervous system (*8,9*). These results suggest that an abnormality exists in IL-1 beta secretion in CFS patients (*7*).

The ω-3 triglycerides contain triglycerides of ω-3 fatty acids, eicosapentanoic acid and docosa hexanoic acid. These long chain ω-3 polyunsaturated fatty acids are precursors of eicosanoids in fish and when taken by man they compete with the precursor arachidonic acid (10).

Omega-3 triglycerides derived from fish oils contain triglycerides of eicosapentanoic acids and docosa hexanoic acids. They have vasodilator, antithrombotic, and anti-inflammatory activity (10,11). Also, several non-marine sources of ω-3 fatty acids have been suggested as possible alternatives for vegetarians and others who cannot eat fish or take fish oils. These include walnuts and walnut oils, wheat germ oil, rapeseed oil, soybeans, butternuts, seaweed and purslane (12). Even so, very small

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increments in intake may have health benefits, possibly the result of a cumulative effect (13).

HYPOTHESIS

These fatty acids decrease the production of putative mediators of inflammation, including platelet-activating factor, interleukin-1, and tumor necrosis factor. Since interleukin-1 and tumor necrosis factor are the principle polypeptides mediator of immunoregulation, reduced production of these cytokines may contribute to the amelioration of immune system diseases in patients receiving ω-3 supplementation (14).

Interleukin-1 and tumor necrosis factor often act synergistically e.g. on the synthesis of arachidonic acid metabolites (13,14). Dietary supplementation with ω-3 fatty acids reduces the amount of inducible production of interlukin-1 and tumor necrosis factor. The reduced production of IL-1α, IL-1β and TNF may contribute to the decreased inflammatory responses reported in patients receiving ω-3 supplementation (14).

The mechanisms underlying the suppression of the synthesis of interleukin-1 and tumor necrosis factor after dietary supplementation with ω-3 fatty acids remain unknown. However alternation in the arachidonic acid metabolites may explain in part the decrease production of these two cytokines. The ω-3 fatty acids induce changes in both cyclo-oxygenase and lipo-oxygenase products. One possible mechanism may be 'competition with arachidonic acid and decreased 5-lipoxygenase metabolites such as leukoterine B4'. Supplementations with ω-3 fatty acids reduce the amount of leukoterine B4 production. Thus a possible mechanism for this, decrease synthesis of leukotrine B4 and generation of the biologically less-active metabolite B5 from eicosapentanoic acid (4,10,13).

Shahar and colleagues found that ω-3 fatty acids reduce the chemotactic responsiveness of neutrophils, inhibit the production of leukotriene B_4 from arachidonic acid in leukocytes, and decrease the production of superoxide anions in leukocytes and this is another possible mechanism (13).

According to these data, we propose that the dietary enriched with ω-3 fatty acids could be a suitable regimen for patients with chronic fatigue syndrome. Studies will have to be performed to determine its efficacy and appropriate dosage.

On the other hand, dietary supplementation involves modulation and not suppression of cytokine production, and the change in cytokine synthesis and cell membrane phospholipids are reversible after cessation of supplement (15).

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